Effectiveness of Predator Guards on Nest Boxes for House Wrens (*Troglodytes aedon*)

A Senior Thesis

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Abstract:

Predation limits reproduction and survival in many animals. Some bird species protect their eggs by laying them in cavities, limiting the predators' access to the nest. Nesting boxes are often used to increase the nesting opportunities of cavity-nesting birds, but they are susceptible to predators. We tested the effectiveness of three types of predator guards relative to a control (no predator guard): "extension" of the entrance to prevent predators from reaching into the nest box, "tube" which prevents predators from getting a grip on the pole, and a "funnel" which predators cannot proceed past. We predicted that the funnel guard would increase the nest success of the House Wrens the most because it would prevent a diverse array of predators from climbing the nest box pole. Additionally, we expected the wrens would nest equally in all of the boxes. Thirty nest boxes of each type (control, extension, tube, and funnel) were distributed equally among a wooded area, a golf course, and a park (120 nest boxes total). House wrens attempted nests in all predator guard types equally. The tube predator guard had the greatest proportion of nests that successfully fledged at least one offspring, whereas wrens nesting in control boxes were the least successful. An unexpected finding was that some predators accessed nest contents by removing the lids and that this occurred most often in the boxes with the entrance extension. Our first prediction was not supported, the tube was the most successful, not the funnel. Our second prediction was supported because the wrens nested equally in all of the boxes. In the future, the box lids should be more secure so they cannot be removed. Additionally, future research should determine whether greasing the tube decreases predation further. This study demonstrates that predator guards are effective in reducing predation of nests in artificial boxes.

Introduction:

In many species of animals, predation limits reproductive success and survival (Martin, 1995). Prey species of birds typically enhance their probability of survival as adults by using camouflage or nesting out of the predators' reach (Dion, et al., 2000). One strategy some bird species utilize to protect their eggs is to lay their eggs in cavities to prevent predators from being able to easily access the eggs (Christman & Dhondt, 1997). However, once found, cavity nesting birds may be more susceptible to predators because they cannot exit the cavity to escape.

Cavity nesters are either primary cavity-nesters or secondary cavity-nesters (Lambrechts, et al., 2010). Secondary cavity-nesting birds cannot excavate their own cavities and must rely on other birds to create nesting places for them. Those birds that make the holes themselves are the primary cavity-nesters (Lambrechts, et al., 2010). Because secondary cavity-nesters must rely on other species to provide a cavity, cavities may not always be available for nesting. Manmade nesting boxes for these secondary cavity-nesters can increase successful reproduction. Nesting success in nest boxes is often higher than in the natural cavities (Robertson & Rendell, 1990). However, predation is still common in the manmade nesting boxes, so predator guards are often added to reduce the predation rates (Cornell, et al., 2011).

Although there is widespread agreement that predator guards should be used to protect the contents of manmade nesting boxes, there is disagreement as to what type of predator guard is most effective. One type of predator guard is an extension of the entrance to prevent predators from being able to reach into the nest box (Randunzel, et al., 1997)

The other two types of predator guards prevent predators from being able to climb the pole holding the nest box. The large-diameter tube around the pole that holds the nest box prevented predators from getting a grip on the pole (Romagnano, et al., 1990). The funnel mounted on the nest box pole prevented predators from proceeded past it (Cornell, et al., 2011). However, these latter two types of predator guards do not exclude predators that can jump or fly to the box.

House Wrens (*Troglodytes aedon*) are a well-suited study subject for the effectiveness of predator guards on nest boxes because they are common throughout the entire North American continent and readily make their nests in manmade boxes (Johnson, 1998). House Wrens are also good candidates for this study because they are accepting of human activity around their nesting areas (Johnson, 1998). Common predators of the House Wrens include raccoons (*Procyon lotor*), squirrels (*Tamiasciurus hudsonicus*), and feral cats (*Felis catus*) (Berner, 1991).

In this study, we constructed three types of predator guards (extension, tube and funnel) for the nest boxes in order to observe which guards will provide the best protection without hindering the use of the nest boxes by House Wrens. Predators observed on our study site include raccoons, grey squirrels (*Sciurus carolinenis*), feral cats, and mink (*Neovison vison*) (pers. comm. JK Augustine). We hypothesized that the funnel guard would increase the nest success of the House Wrens the most because they would prevent the greatest diversity of predators from being able to reach the box, while predators may be able to find ways around the other types of predator guards. We also predicted that the

House Wrens would nest equally in all of the nest boxes, regardless of the type of predator guard.

Methods:

Study Species

House Wrens are one of the most well-known songbirds in North America (Johnson, 1998). They are secondary cavity-nesters, therefore they typically use abandoned nests or manmade nest boxes (Lambrechts, et al., 2010). The nesting season for House Wrens is generally from late April to mid-July (Kendeigh, 1963). Females usually have two clutches during each breeding season (Kendeigh, 1963). They usually have clutch sizes that are 4-8 eggs and both parents provide for the nestlings (Poirier, et al., 2003).

Field Techniques

Forty nest boxes were placed in each of three locations (120 nest boxes total): a wooded area, a golf course, and a park. The wooded area (40.744445 -84.018472) and the park (40.736015 -84.030596) were located on the Ohio State University campus in Lima. The golf course, Hawthorne Hills Country Club (40.755621 -84.030446), was located within 5 km of campus. Nest boxes at the wooded area and golf course have been in place since 2010, but the park location was added in 2013. The park location consists of wooded edges surrounding a baseball diamond and other large, mowed areas. Despite the use of different habitats in previous years, nesting success did not vary by habitat (Sawmiller, 2012), so, based on proximity, we expected a similar suite of predators in each location.

The nest boxes were 10.1 cm wide by 14.0 cm long by 20.3 cm high with an entrance circle with a diameter of 2.9 cm. The nest boxes were attached to 1.82 m studded T-posts pounded 0.46 m into the ground. The nest boxes were 30 m apart to ensure each would get maximum usage without territorial intrusions between males (Muller, et al., 1997).

Three types of predator guards were used (Figure 1). The 'extension' of the entrance hole was a 7cm by 8cm by 12cm extension constructed using 1-cm by 1-cm wire fencing. The 'funnel' was attached to the nest box pole directly under the box. The mouth of the funnel had a diameter of 39cm and was pointed downwards. The 'tube' was also attached to the nest box pole and it was 76cm long and 11cm in diameter. Control boxes did not have any type of predator guard. The initial order of three predator guards and control was drawn randomly for each study location and repeated every four boxes. Therefore, there were 10 of each type (three types of predator guards and control) at each location.

The nest boxes were observed every 2-3 days beginning at the end of April, 2012, and continuing until the second brood has fledged (late August, 2012). When there was 4 cm or more of nesting material, nests were checked daily to determine when the first egg was laid. Twelve days after the completion of the clutch (two consecutive days without an increase in clutch size), the nests were checked daily again to determine the exact date of hatching (>50% of the eggs hatch). Seventeen days after hatching, nests were checked to determine whether the offspring successfully left the nest or not. From these observations we were able to determine which boxes had nests attempted in them and fledging success.

Statistical Analyses

We compared number of boxes occupied and unoccupied with the type of predator guard on the box to determine whether the type of predator guard influences where wrens build their nests. To determine if the predator guard actually prevented depredation, we compared the type of predator guard with the nesting success. Nesting success included three categories: 1) successful: at least one nestling survived until fledging, 2) unsuccessful/lid on: the nest did not produce any nestlings but the lid remained in place, 3) unsuccessful/lid off which means the nest did not produce any nestlings and the lid was removed. We also determined whether nesting success varied by location. All analyses were likelihood ratio χ^2 analyses conducted in Program JMP (Version 9.0.0, SAS Institute Inc., Cary, NC).

<u>Results:</u>

Of the 120 nest boxes that were available for the House Wrens, 63% of the boxes had at least one nesting attempt (at least 1 egg laid). Some wrens attempted multiple nests in the same box, for a total of 109 nesting attempts. Of the 109 nests attempted, 53% were successful and 47% were unsuccessful. Of the nests that were unsuccessful, 31% had the lids removed at the time of predation. The earliest nest was started on May 5th, 2013 and the latest nest was started on July 31st ,2013.

House Wrens attempted nests in all predator guard types equally (χ^2=5.39, N=120 boxes, P=0.15). Nest success varied among predator guard types (Figure 2; χ^2= 16.79, N=109, P<0.001). As expected, the control boxes had more unsuccessful nests with the lid on than average. The extension predator guard type was less successful and had the lid removed more often than was expected. The tube predator guard type had more successful nests than any other predator guard. The funnel predator guard had intermediate numbers of nests in all three categories.

Nesting success also varied by location. The park was the most successful location, followed by the woods, and finally the golf course (Figure 3; χ^2=36.09, N=109, P<0.0001).

Discussion:

Our hypothesis was that the funnel predator guard would increase the nest success of the House Wrens the most. Our hypothesis was not supported, because the tube predator guard was the most successful in decreasing the amount of predation on the boxes while the extension was the least successful in decreasing predation. Surprisingly, there was an increased rate of the lid being removed from the box with the extension predator guard. We hypothesize that this could be due to the large size our extended entrance allowing predators to stand on the extension while working to remove the lid. Studies with Eastern Bluebirds (*Sialia sialis*) have also shown that tube predator guards increase nesting success (Randunzel, et al., 1997, Cornell, et al., 2011). However, our study improves on these studies by examining multiple types of predator guards simultaneously with a replicated experimental design which included control boxes without predator guards.

Our second prediction that House Wrens would nest equally in the all of the nest boxes, regardless of the type of predator guard, was supported. Again, another study with Eastern Bluebirds also demonstrated that the birds nested equally in the nest boxes provided regardless of the different predator guard types (Cornell, et al., 2011). Interestingly, research conducted with Eastern Bluebirds showed that the birds avoided nest boxes with an extension type predator guard (Berner, 1991), but the extension was constructed differently than in our study. The extension used in Berner (1991) was round and fit directly on the entrance of the nest box with small holes in it. Our extension, on the other hand, was made of wire fencing and not a direct extension of the nest box hole.

Contrary to previous findings, the nesting success of House Wrens varied by location, with the park having the highest nesting success and the golf course having the lowest nesting success. The golf course had the most nests attempted, but it had the highest predation rate. This could be due to the House Wrens readily renesting after depredation. The golf course and the woods may be different in attempt rates and success rate because of the different predator communities in their areas. Our findings disagree with research conducted at the same golf course and woods locations in previous years. Krohn (2012) and Sawmiller (2012) showed there was no link between the success of the nests and the locations of the boxes, even though they used a residential area with more divergent vegetation in lieu of the park. The residential area had more ornamental shrubs and flowers, and less vegetation overall than the golf course, the woods, or the park. Krohn (2012) and Sawmiller (2012) both predicted that the House Wrens would be less successful in the areas with human interaction, but this prediction was not supported by their findings. House Wrens seem to favor habitats with moderate human disturbance (Pogue & Schnell, 1994). The park was the most successful location during our study, but this could be because of the newness of the area and the predators not being accustomed to the nest boxes. Kahn (2013) observed that the predation rates have increased over the years at the same golf course, woods, and residential locations as the current study.

Our research shows that the most successful predator guard to decrease predation was the tube predator guard. To know whether predation rates will increase at the park over time or whether there is something uniquely beneficial to the wrens at the park, continued research will need to be conducted at this location. This research suggests that predator guards of the right type can be successful in preventing predation, but others may actually increase predation on certain types of nesting boxes.

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FIGURE 1: Photographs of the three types of predator guards used (A-C) compared to a control nesting box without any type of predator guard (D).

A. Extension B. Tube C. Funnel D. Control

FIGURE 2: The relationship between the predator guard type and the deviation from the expected value of nest success for House Wrens in Allen County, OH, May-August 2013.

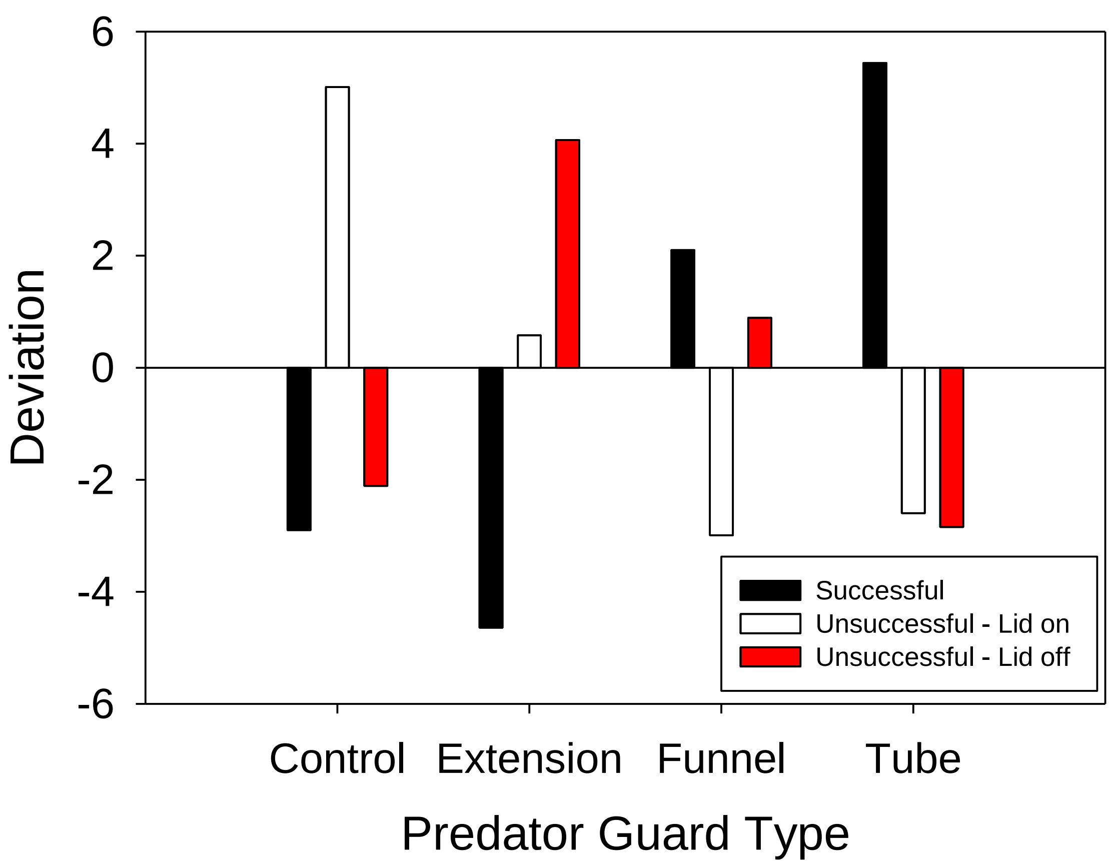

FIGURE 3: The relationship between the location of the nest boxes and deviation from the expected value of nest success for House Wrens in Allen County, OH, May-August 2013.